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U.S. Bureau of Mines

Accidents at metallurgical works in the United States

Washington

1915

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DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
VAN. H. MANNING, Director

ACCIDENTS AT METALLURGICAL WORKS IN THE UNITED STATES

DURING THE CALENDAR YEARS 1913 AND 1914

COMPILED BY

ALBERT H. FAY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1915

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ACCIDENTS AT METALLURGICAL WORKS IN THE UNITED STATES DURING THE CALENDAR YEARS 1913 AND 1914.

Compiled by ALBERT H. FAY.

INTRODUCTION.

This paper is the first report of the Bureau of Mines on accidents at metallurgical works, and is for the calendar years 1913 and 1914. During these two years 119 men were killed, 2,285 seriously injured, and 11,046 slightly injured at smelters and mills representing fatality and injury rates of 1.55, 29.67, and 143.44, respectively, per 1,000 men employed. The report includes the returns of 79 smelting plants in 1913 and 94 in 1914, including copper, lead and zinc, and quicksilver smelters, as well as refineries. The iron blast furnaces are not included in the figures given herein. The number of ore-dressing plants reporting in 1913 was 311, and in 1914, 484. These represent concentrating plants of copper, lead, and zinc ores, stamp mills, cyanide plants, and iron-ore washers.

A request for reports of accidents at metallurgical plants was sent out late in 1914 for the year 1913, and there were a number of companies that did not render reports, the request being the first made by the bureau for reports of accidents at such plants. A larger number of operators reported for the year 1914 than did for 1913, as indicated above. The total number of men reported employed in the metallurgical plants, both smelters and ore-dressing plants, was 35,549 in 1913 and 41,461 in 1914.

Slight increases in fatality or accident rates in 1914 as compared with 1913 may be apparent rather than real, because of more detailed reports having been made for 1914.

ACKNOWLEDGMENTS.

The data presented in this paper were voluntarily supplied by the officials and managers of the metallurgical companies at the request of the bureau, there being no law compelling such companies to render a report. The bureau gratefully acknowledges the hearty cooperation of the many officials who have answered its inquiries, and invites suggestions whereby the annual report of accidents at metallurgical plants may be improved so as to best serve the industry.

SERIOUS AND SLIGHT INJURIES.

The definition of an accident, which is of fundamental importance, is different among the various mining and metallurgical companies. One operator may require a detailed report of any casualty, however slight, that delays the worker, or that draws blood; another may not consider an accident worthy of record that does not come to the attention of the foreman or shift boss.

The higher accident rate in one State as compared with those of other States may be due to the fact that more complete records have been kept. Companies employing only a few men do not, as a rule, keep a complete register of the serious and slight injuries; hence these ratios in some States may be low, but such low rates do not necessarily indicate that the danger is less than in an adjoining State.

SERIOUS INJURY.

The distinction made in this report between a serious and a slight injury is entirely arbitrary and is in accordance with that used by the bureau in the collection of statistics of mine and quarry accidents since 1911. A line had to be drawn at some definite point, and hence a serious accident is considered in this report as one that would disable a man and keep him from duty 20 days or more. This class includes such injuries as broken arms and legs, loss of eye, and severe cuts and bruises.

SLIGHT INJURY.

A slight injury is considered as one that involves a loss of time of more than 1 day but less than 20 days. Under this class may be placed such injuries as cuts, sprains, mashed fingers, bruises, dirt in eye, and slight burns. Of course any slight injury may become infected, and thus result in a serious accident as defined above.

REVISED CLASSIFICATION OF INJURIES FOR 1915.

Many of the States now have compensation laws, and in order to conform with their classifications the bureau's classification of serious and slight injuries for 1915 will be on a 14-day (2-week) basis instead of 20-day, as at present. The new classification of injuries will include three types, as follows:

1. Fatal.
2. Serious (time lost, more than 14 days):
    (*a*) Permanent disability.
        Total.
        Partial.
    (*b*) Others.
3. Slight (time lost, 1 to 14 days, inclusive).

ACCIDENTS AT SMELTERS.

In 1913 the number of men killed at smelting plants was 47, or 2.29 per 1,000 men employed; in 1914 the number killed was 33, or 1.22 per 1,000 employed. In 1913 there were reported 740 serious injuries, or 35.99 per 1,000 employed, as compared with 1,015 in 1914, or 37.65 per 1,000 employed. The number of slight injuries reported in 1913 was 3,507, or 170.54 per 1,000 employed, as compared with 4,658 in 1914, or 172.77 per 1,000 employed. Table 1 presents a summary of accidents at smelting plants by causes and by States, showing the number killed and seriously and slightly injured during the calendar years 1913 and 1914. At the bottom of the table comparative fatality and injury ratios at ore-dressing plants, coke ovens, quarries, and metal mines are given.

Tables 3 and 4 show the number of men employed and the number of days worked at smelters, by States, for the years 1913 and 1914. They also show the total number killed and injured, with fatality and injury ratios for each State. Tables 5 to 10, inclusive, show fatalities and injuries by causes and States for 1913 and 1914.

ACCIDENTS AT ORE-DRESSING PLANTS.

The number killed in the ore-dressing plants in 1913 was 16, or 1.07 per 1,000 employed; the number killed in 1914 was 23, or 1.59 per 1,000 employed. The injuries reported in 1913 were 307 serious and 1,670 slight, as compared with 223 serious and 1,211 slight in 1914. Table 2 is a summary of the accidents by causes and by States for the years 1913 and 1914.

Tables 11 and 12 show the number of employees by States, the number of days' work performed, together with the number killed and injured, with fatality and injury rates calculated for each State. Tables 13 to 18, inclusive, show the number killed and injured at ore-dressing plants, classified by causes and States, during the calendar years 1913 and 1914.

CAUSES OF ACCIDENTS.

The percentage of accidents due to any one cause is given in the following table:

Accidents at ***ore-dressing*** *and* ***smelting plants*** *in the United States, classified by principal causes, during 1913 and 1914 combined.*

Cause of accident.	Ore-dressing plants.			Smelting plants.		
	Killed.	Seriously injured.	Slightly injured.	Killed.	Seriously injured.	Slightly injured.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Haulage	12.8	9.6	6.9	25.0	14.0	9.7
Machinery	25.6	28.9	16.5	18.7	9.0	5.7
Falls of persons	15.4	16.0	12.4	20.0	13.8	9.5
Suffocation in ore bins	7.7	....	.1	3.7	.2	.1
Flying or falling objects	15.4	16.0	23.8	5.0	14.7	17.1
Electricity	7.7	1.7	1.4	5.0	.6	1.2
Hand tools	....	5.3	10.5	....	6.9	10.9
Nails, splinters, etc.	....	1.1	5.1	....	.3	2.1
Burns (steam, water, matte, slag)	....	1.0	1.0	11.3	26.7	20.6
Other causes	15.4	20.4	22.3	11.3	13.8	23.1

In the ore-dressing plants machinery was responsible for 25.6 per cent of all fatalities, 28.9 per cent of the serious injuries, and 16.5 per cent of the slight injuries. Similar figures for smelting plants are much smaller, for the reason that there is more machinery in use in ore-dressing plants than at smelters, and the men are usually in closer contact with the machinery, as, for example, at jigs, tables, stamps, rolls, and crushers. There are many revolving shafts, a large number of which have projecting keys, moving belts, wheels, and cams within the reach of the operator. The machinery at smelting plants is usually confined to the power house, where the blowers, engines, and dynamos are placed, and to overhead cranes, most all of which are entirely out of the reach of the regular smelter employees.

The percentage of accidents due to "falls of persons" and "flying and falling objects" is 15.4 per cent for each in ore-dressing plants, whereas at the smelters the fatalities due to falls of persons represent 20 per cent of the total, and those due to flying or falling objects represent 5 per cent.

Haulage systems cause 25 per cent of the fatalities at smelting plants, and about half this percentage at ore-dressing plants. The difference is largely due to the type of material handled and to the larger number of cars in operation around smelter yards than are at ore-dressing plants. In many ore-dressing plants the ore is brought to the bins in railroad cars or aerial trams, and often there is no other haulage system in connection with the plants, the tailings usually being disposed of by launders or flumes, whereas at smelting plants the molten slag is usually handled in slag cars and the bullion has to be handled on trucks.

At smelting plants burns from hot metal, slag, etc., claim the largest percentage of serious and slight injuries and 11.3 per cent of the fatalities.

The tables presented herein will serve to call attention to the principal causes of accidents at these works and should serve as guides for the safety engineer to show where it will be possible for him to do his work most efficiently and to accomplish the best results. Little has been written on the subject of metallurgical accidents, other than for the iron and steel industry, and statistical information is far from being complete.

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STATISTICAL TABLES.

The tables showing the classification and the number of accidents at metallurgical works in the United States during the calendar years 1913 and 1914 follow:

TABLE 1.—*Summary of accidents at* ***smelting plants*** *in the United States, 1913 and 1914.*

	Killed.		Seriously injured.		Slightly injured.	
	1913	1914	1913	1914	1913	1914
Accidents by causes:						
Haulage system (cars, motors, etc.)	5	3	80	110	306	385
Railway cars or locomotives	5	7	21	34	54	77
Crushers	0	0	7	6	12	7
Cranes	4	0	18	17	50	38
Blowers	0	0	0	0	2	3
Other machinery	8	3	45	66	187	168
Falls of persons	10	6	95	147	269	473
Suffocation in ore bins	1	2	3	1	10	0
Flying or falling objects (rocks, timbers, etc.)	3	1	102	157	501	895
Gas (burning or asphyxiation)	0	0	2	3	16	56
Scalding (steam or water)	0	1	11	21	34	41
Electricity	2	2	4	6	53	43
Hand tools	0	0	44	77	379	509
Nails, splinters, etc	0	0	2	3	77	93
Furnace slips	0	0	2	2	15	6
Burns from matte, slag, or molten metal (pouring or spilling)	4	2	174	191	603	768
Hot-metal explosions	2	0	28	43	120	119
Other causes	3	6	102	131	819	977
Total number killed or injured	**47**	**33**	**740**	**1,015**	**3,507**	**4,658**
Accidents by States:						
Arizona	15	3	187	136	618	417
California	2	1	88	44	56	119
Colorado	1	2	57	126	238	510
Illinois	2	3	46	73	225	624
Kansas	0	0	11	11	52	78
Missouri	0	0	20	20	333	237
Montana	4	6	37	62	353	476
Nevada	5	1	17	8	111	25
New Jersey	2	3	28	131	172	491
New York	1	1	0	3	15	46
Oklahoma	3	1	23	14	98	83
Pennsylvania	0	1	19	9	232	196
Tennessee	0	1	29	51	343	275
Utah	10	5	95	161	459	444
West Virginia	1	0	7	14	79	47
Other States	1	5	76	152	123	590
Total number killed or injured	**47**	**33**	**740**	**1,015**	**3,507**	**4,658**
Number killed or injured per 1,000 employees:						
Smelting plants	**2.29**	**1.22**	**35.99**	**37.65**	**170.54**	**172.77**
Ore-dressing plants	**1.07**	**1.59**	**20.49**	**15.38**	**111.44**	**83.51**
Coke ovens	1.89	2.02	14.05	13.53	89.22	84.57
Quarries	1.72	2.05	10.28	14.66	62.55	74.45
Metal mines (surface only)	2.06	....	21.75	....	92.13	....
Metal mines (total)	3.54	....	30.50	....	140.25	....
Coal mines (total)	3.73	3.22	....	....	....	....

TABLE 2.—*Summary of accidents at* ***ore-dressing plants*** *in the United States, 1913 and 1914.*

	Killed.		Seriously injured.		Slightly injured.	
	1913	1914	1913	1914	1913	1914
Accidents by causes:						
Haulage system (cars, motors, etc.)	1	0	19	19	79	60
Railway cars or locomotives	1	3	10	3	24	35
Crushers	0	0	6	6	27	17
Rolls or stamps	0	2	7	8	24	33
Tables, jigs, etc	0	0	14	10	51	36
Other machinery	2	6	61	41	158	129
Falls of persons	3	3	51	34	187	171
Suffocation in ore bins	1	2	0	0	0	2
Falling objects (rocks, timbers, etc.)	3	3	51	21	316	201
Cyanide or other poisoning	1	0	1	1	7	8
Scalding (steam or water)	0	0	4	1	20	8
Electricity	1	2	5	4	16	26
Hand tools	0	0	14	14	185	119
Nails, splinters, etc	0	0	1	5	73	73
Flying pieces of rock from sledging or crusher	0	0	4	9	128	41
Other causes	3	2	59	47	375	252
Total number killed or injured	**16**	**23**	**307**	**223**	**1,670**	**1,211**
Accidents by States:						
Alabama	0	0	1	0	15	1
Alaska	(a)	1	(a)	3	(a)	27
Arizona	4	5	64	58	271	229
California	0	1	7	17	29	94
Colorado	5	2	30	17	97	86
Idaho	1	1	7	5	23	14
Illinois	0	0	1	2	33	1
Michigan	0	1	8	25	17	26
Missouri	1	2	11	12	198	168
Montana	1	4	23	20	166	101
Nevada	0	2	19	18	64	65
New Jersey	0	0	4	5	25	22
New Mexico	1	0	7	8	104	87
New York	0	0	0	4	0	8
Oklahoma	0	0	3	4	8	31
Oregon	0	0	0	1	3	4
South Dakota	0	0	5	4	29	6
Tennessee	0	0	2	0	11	1
Texas	0	0	0	1	0	6
Utah	2	4	97	16	434	195
Virginia	0	0	2	1	18	4
Washington	0	0	0	0	0	0
Wisconsin	0	0	3	0	65	16
Other States	1	0	13	2	60	19
Total number killed or injured	**16**	**23**	**307**	**223**	**1,670**	**1,211**

[a] No report rendered.

TABLE 3.—*Number of men employed, number of days worked, and number of men killed and injured at* **smelting plants** *in the United States in the calendar year* ***1913.***

State.	Number of employees.	Total days worked.	Average days active.	Number killed.		Number seriously injured.		Number slightly injured.		Widows.	Orphans.
				Total.	Per 1,000 employed.	Total.	Per 1,000 employed.	Total.	Per 1,000 employed.		
Arizona	2,979	1,064,714	357	15	5.04	187	62.77	618	207.45	4	5
California	1,093	351,610	322	2	1.83	88	80.51	56	51.24	1	....
Colorado	2,734	989,335	362	1	.37	57	20.85	238	87.05	....	....
Illinois	1,946	697,120	358	2	1.27	46	23.64	225	115.62	1	....
Kansas	800	268,870	336	....	....	11	13.75	52	65.00	....	....
Missouri	1,096	392,467	358	....	....	20	18.25	333	303.83	....	....
Montana	1,224	446,645	365	4	3.27	37	30.23	353	288.40	2	1
Nevada	840	303,846	362	5	5.95	17	20.24	111	132.14	1	3
New Jersey	757	275,288	364	2	2.64	28	36.99	172	227.21	1	2
New York	110	35,500	323	1	9.09	....	....	15	136.36	1	4
Oklahoma	1,181	431,065	365	3	2.54	23	19.48	98	82.98	1	3
Pennsylvania	1,527	549,640	360	....	....	19	12.44	232	151.93	....	....
Tennessee	460	164,700	358	....	....	29	63.04	343	745.65	....	....
Utah	1,609	587,285	365	10	6.22	95	59.04	459	285.27	6	20
West Virginia	919	329,605	359	1	1.09	7	7.62	79	85.96	....	....
Other States [a]	1,289	405,076	314	1	.78	76	58.96	123	95.42	....	....
Total	**20,564**	**7,292,766**	**355**	**47**	**2.29**	**740**	**35.99**	**3,507**	**170.54**	**18**	**38**

[a] Includes Indiana, Michigan, New Mexico, Ohio, Oregon, South Dakota, Texas, Virginia, and Washington.

TABLE 4.—*Number of men employed, number of days worked, and number of men killed and injured at* **smelting plants** *in the United States in the calendar year* ***1914.***

State.	Number of employees.	Total days worked.	Average days active.	Number killed.		Number seriously injured.		Number slightly injured.		Widows.	Orphans.
				Total.	Per 1,000 employed.	Total.	Per 1,000 employed.	Total.	Per 1,000 employed.		
Arizona	2,491	875,543	351	3	1.20	136	54.60	417	167.40	3	2
California	917	314,162	343	1	1.09	44	47.98	119	129.77	....	....
Colorado	2,810	1,006,670	358	2	.71	126	44.84	510	181.49	1	3
Illinois	3,228	1,167,544	362	3	.93	73	22.61	624	193.31	1	2
Kansas	942	337,890	359	....	....	11	11.68	78	82.80	....	....
Missouri	980	353,126	360	....	....	20	20.41	237	241.84	....	....
Montana	1,589	507,198	319	6	3.78	62	39.02	476	299.56	4	8
Nevada	726	253,006	348	1	1.38	8	11.02	25	34.44	1	6
New Jersey	3,567	1,214,362	340	3	.84	131	36.73	491	137.65	2	5
New York	210	64,500	307	1	4.76	3	14.29	46	219.05	1	3
Oklahoma	1,210	424,145	351	1	.83	14	11.57	83	68.60	1	....
Pennsylvania	1,279	452,803	354	1	.78	9	7.04	196	153.24	1	2
Tennessee	299	105,229	352	1	3.34	51	170.57	275	919.73	....	....
Utah	2,779	1,013,095	365	5	1.80	161	57.93	444	159.77	4	2
West Virginia	826	294,015	356	....	....	14	16.95	47	56.90	....	....
Other States [a]	3,107	1,031,948	332	5	1.61	152	48.92	590	189.89	3	3
Total	**26,960**	**9,415,236**	**349**	**33**	**1.22**	**1,015**	**37.65**	**4,658**	**172.77**	**22**	**36**

[a] Includes Indiana, Michigan, Nebraska, Ohio, Texas, Virginia, Washington, and Wisconsin.

TABLE 5.—*Number of men* **killed** *at* **smelting plants** *in the United States, by causes, in the calendar year* **1913.**

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Cranes. 4	Blowers. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Flying or falling objects (rocks, timbers, etc.). 9	Gas (burning or asphyxiation). 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Furnace slips. 15	Burns from matte, slag, or molten metal (pouring or spilling). 16	Hot-metal explosions. 17	Other causes. 18	**Total.**
Arizona	3			3		2	3		1			1					2		15
California		1					1												2
Colorado						1													1
Illinois		1																1	2
Kansas																			
Missouri																			
Montana		2				1	1												4
Nevada		1					1									1		2	5
New Jersey						2													2
New York																1			1
Oklahoma							1	1				1							3
Pennsylvania																			
Tennessee																			
Utah	1			1		2	3		1							2			10
West Virginia									1										1
Other States [a]	1																		1
Total	5	5		4		8	10	1	3			2				4	2	3	47

[a] Includes Indiana, Michigan, New Mexico, Ohio, Oregon, South Dakota, Texas, Virginia, and Washington.

TABLE 6.—*Number of men* **killed** *at* **smelting plants** *in the United States, by causes, in the calendar year* **1914.**

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Cranes. 4	Blowers. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Flying or falling objects (rocks, timbers, etc.). 9	Gas (burning or asphyxiation). 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Furnace slips. 15	Burns from matte, slag, or molten metal (pouring or spilling). 16	Hot-metal explosions. 17	Other causes. 18	**Total.**
Arizona												1				1		1	3
California							1												1
Colorado							2												2
Illinois	1					1												1	3
Kansas																			
Missouri																			
Montana	1	1				1	1		1			1							6
Nevada		1																	1
New Jersey		1														1		1	3
New York							1												1
Oklahoma											1								1
Pennsylvania						1													1
Tennessee								1											1
Utah		2					1	1										1	5
West Virginia																			
Other States [a]	1	2																2	5
Total	3	7				3	6	2	1		1	2				2		6	33

[a] Includes Indiana, Michigan, Nebraska, Ohio, Texas, Virginia, Washington, and Wisconsin.

TABLE 7.—*Number of men* ***seriously injured*** *at* ***smelting plants*** *in the United States, by causes, in the calendar year* ***1913.***

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Cranes. 4	Blowers. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Flying or falling objects (rocks, timbers, etc.). 9	Gas (burning or asphyxiation). 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Furnace slips. 15	Burns from matte, slag, or molten metal (pouring or spilling). 16	Hot-metal explosions. 17	Other causes. 18	Total.
Arizona	21	......	......	6	......	12	15	3	17	......	2	1	8	......	......	75	14	13	**187**
California	4	4	......	......	......	3	14	......	12	......	......	1	9	1	......	10	......	30	**88**
Colorado	8	......	......	2	......	6	10	......	9	......	......	......	3	1	......	10	7	1	**57**
Illinois	3	2	1	......	......	......	11	......	1	1	2	......	5	......	......	4	......	16	**46**
Kansas	......	......	1	......	......	......	......	......	1	......	......	......	1	......	......	5	......	3	**11**
Missouri	2	......	......	......	......	1	4	......	5	......	......	......	1	......	......	6	......	1	**20**
Montana	3	5	......	1	......	6	5	......	3	......	......	......	4	......	2	2	1	5	**37**
Nevada	......	4	......	......	......	1	2	......	4	......	......	......	......	......	......	4	1	1	**17**
New Jersey	3	......	......	......	......	1	......	......	3	......	4	1	1	......	......	8	......	7	**28**
New York	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Oklahoma	4	2	4	......	......	3	2	......	2	1	1	......	1	......	......	1	......	2	**23**
Pennsylvania	2	......	......	......	......	......	5	......	4	......	......	......	1	......	......	5	......	2	**19**
Tennessee	2	......	......	......	......	1	......	......	4	......	1	......	8	......	......	11	2	......	**29**
Utah	11	4	......	2	......	7	14	......	18	......	......	1	......	......	......	18	3	17	**95**
West Virginia	......	......	......	......	......	......	1	......	......	......	......	......	......	......	......	6	......	......	**7**
Other States[a]	17	......	1	7	......	4	12	......	19	......	1	......	2	......	......	9	......	4	**76**
Total	**80**	**21**	**7**	**18**	......	**45**	**95**	**3**	**102**	**2**	**11**	**4**	**44**	**2**	**2**	**174**	**28**	**102**	**740**

[a] Includes Indiana, Michigan, New Mexico, Ohio, Oregon, South Dakota, Texas, Virginia, and Washington.

TABLE 8.—*Number of men* ***seriously injured*** *at* ***smelting plants*** *in the United States, by causes, in the calendar year* ***1914.***

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Cranes. 4	Blowers. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Flying or falling objects (rocks, timbers, etc.). 9	Gas (burning or asphyxiation). 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Furnace slips. 15	Burns from matte, slag, or molten metal (pouring or spilling). 16	Hot-metal explosions. 17	Other causes. 18	Total.
Arizona	14	......	2	1	......	13	16	......	21	......	1	2	9	1	......	23	8	25	**136**
California	8	4	......	1	......	1	5	......	3	......	......	1	......	......	......	8	1	12	**44**
Colorado	13	2	......	1	......	10	21	......	5	......	2	1	23	......	......	31	4	13	**126**
Illinois	6	4	......	......	......	......	15	......	10	1	2	......	5	1	......	14	4	11	**73**
Kansas	......	......	......	1	......	......	......	......	......	......	1	......	4	......	......	3	......	2	**11**
Missouri	2	......	......	......	......	4	2	......	3	......	1	......	......	......	......	6	2	......	**20**
Montana	6	6	......	1	......	4	19	......	8	......	......	......	7	......	......	7	2	2	**62**
Nevada	......	1	......	......	......	1	1	......	......	......	......	......	......	......	......	2	......	3	**8**
New Jersey	9	3	......	7	......	4	13	......	39	......	11	......	5	1	......	16	5	18	**131**
New York	......	......	......	......	......	1	......	......	......	......	......	......	......	......	......	1	......	1	**3**
Oklahoma	3	......	......	......	......	2	2	......	......	1	1	......	......	......	......	3	1	1	**14**
Pennsylvania	......	......	......	......	......	......	1	......	2	......	......	......	1	......	......	2	......	3	**9**
Tennessee	8	......	......	1	......	2	3	......	6	......	......	......	6	......	......	11	8	6	**51**
Utah	23	7	1	3	......	14	23	......	34	......	......	2	8	......	1	30	3	12	**161**
West Virginia	1	......	......	......	......	......	1	......	1	......	......	......	......	......	......	10	......	1	**14**
Other States[a]	17	7	3	1	......	10	25	1	25	1	2	......	9	......	1	24	5	21	**152**
Total	**110**	**34**	**6**	**17**	......	**66**	**147**	**1**	**157**	**3**	**21**	**6**	**77**	**3**	**2**	**191**	**43**	**131**	**1,015**

[a] Includes Indiana, Michigan, New Mexico, Ohio, Oregon, South Dakota, Texas, Virginia, and Washington.

TABLE 9.—*Number of men* **slightly injured** *at* **smelting plants** *in the United States, by causes, in the calendar year* **1913.**

	Haulage system (cars, motors, etc.).	Railway cars or locomotives.	Crushers.	Cranes.	Blowers.	Other machinery.	Falls of persons.	Suffocation in ore bins.	Flying or falling objects (rocks, timbers, etc.).	Gas (burning or asphyxiation).	Scalding (steam or water).	Electricity.	Hand tools.	Nails, splinters, etc.	Furnace slips.	Burns from matte, slag, or molten metal (pouring or spilling).	Hot-metal explosions.	Other causes.	**Total.**
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Arizona	51	......	1	10	......	55	45	8	109	1	7	16	69	21	......	94	28	103	**618**
California	2	3	......	2	......	3	5	......	1	1	......	......	2	2	......	10	4	21	**56**
Colorado	45	......	......	1	......	12	34	......	28	2	3	1	41	4	......	44	9	14	**238**
Illinois	17	4	......	......	......	8	8	2	17	3	4	1	22	8	5	47	3	76	**225**
Kansas	......	1	......	......	......	3	4	......	2	......	......	......	2	1	2	15	......	22	**52**
Missouri	18	......	......	......	......	4	23	......	63	......	1	......	13	3	......	84	23	101	**333**
Montana	37	6	......	12	......	20	41	......	61	2	4	6	47	9	3	29	12	64	**353**
Nevada	3	12	......	1	......	12	11	......	21	1	1	3	1	1	......	19	2	23	**111**
New Jersey	19	......	......	3	1	5	10	......	41	3	2	2	15	4	......	15	3	49	**172**
New York	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	5	......	10	**15**
Oklahoma	15	1	8	......	......	8	6	......	9	1	3	4	7	1	1	25	4	5	**98**
Pennsylvania	13	1	......	1	......	5	21	......	34	2	4	1	41	2	......	33	12	62	**232**
Tennessee	18	9	......	3	......	9	5	......	22	......	4	7	34	4	3	66	16	143	**343**
Utah	43	14	3	15	1	31	41	......	66	......	1	11	48	12	......	73	3	97	**459**
West Virginia	2	......	......	......	......	3	11	......	1	......	......	1	22	1	......	26	......	12	**79**
Other States [a]	23	3	......	2	......	9	4	......	26	......	......	......	15	4	1	18	1	17	**123**
Total	**306**	**54**	**12**	**50**	**2**	**187**	**269**	**10**	**501**	**16**	**34**	**53**	**379**	**77**	**15**	**603**	**120**	**819**	**3,507**

[a] Includes Indiana, Michigan, New Mexico, Ohio, Oregon, South Dakota, Texas, Virginia, and Washington.

TABLE 10.—*Number of men* **slightly injured** *at* **smelting plants** *in the United States, by causes, in the calendar year* **1914.**

	Haulage system (cars, motors, etc.).	Railway cars or locomotives.	Crushers.	Cranes.	Blowers.	Other machinery.	Falls of persons.	Suffocation in ore bins.	Flying or falling objects (rocks, timbers, etc.).	Gas (burning or asphyxiation).	Scalding (steam or water).	Electricity.	Hand tools.	Nails, splinters, etc.	Furnace slips.	Burns from matte, slag, or molten metal (pouring or spilling).	Hot-metal explosions.	Other causes.	**Total.**
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Arizona	22	......	1	3	......	34	51	......	45	......	7	9	60	7	1	65	10	102	**417**
California	9	4	......	......	......	4	23	......	26	1	1	2	4	4	......	10	3	28	**119**
Colorado	36	5	......	1	......	29	65	......	78	2	7	2	85	4	......	112	7	77	**510**
Illinois	58	15	......	......	......	15	56	......	94	33	2	4	44	9	3	92	19	180	**624**
Kansas	......	......	1	......	2	4	1	......	1	1	2	......	20	2	1	14	3	26	**78**
Missouri	16	3	......	......	......	6	13	......	85	......	......	......	19	......	......	50	10	35	**237**
Montana	56	3	1	3	......	21	55	......	86	4	1	2	71	19	......	68	18	68	**476**
Nevada	......	1	......	......	......	2	2	......	......	1	......	......	6	......	......	3	1	9	**25**
New Jersey	31	9	......	5	......	8	43	......	137	6	9	6	36	10	......	51	7	133	**491**
New York	......	......	......	1	......	......	3	......	......	......	1	......	1	......	......	16	......	24	**46**
Oklahoma	9	......	......	......	......	5	3	......	5	4	......	1	8	1	......	29	3	15	**83**
Pennsylvania	5	......	......	......	......	3	25	......	32	4	3	......	27	1	......	37	......	59	**196**
Tennessee	21	......	......	4	......	3	18	......	36	......	2	12	32	3	......	44	17	83	**275**
Utah	44	20	2	16	1	21	41	......	111	......	4	3	42	11	......	65	11	52	**444**
West Virginia	1	......	......	......	......	3	7	......	3	......	......	......	8	4	......	20	......	1	**47**
Other States [a]	77	17	2	5	......	10	67	......	156	......	2	2	46	18	1	92	10	85	**590**
Total	**385**	**77**	**7**	**38**	**3**	**168**	**473**	......	**895**	**56**	**41**	**43**	**509**	**93**	**6**	**768**	**119**	**977**	**4,658**

[a] Includes Indiana, Michigan, Nebraska, Ohio, Texas, Virginia, Washington, and Wisconsin.

TABLE 11.—*Number of men employed, number of days worked, and number of men killed and injured at* **ore-dressing plants** *in the United States, in the calendar year* ***1913***.

State.	Number of employees.	Total days worked.	Average active days.	Number killed.		Number seriously injured.		Number slightly injured.		Widows.	Orphans.
				Total.	Per 1,000 employed.	Total.	Per 1,000 employed.	Total.	Per 1,000 employed.		
Alabama	130	31,250	240	....	....	1	7.69	15	115.38	....	....
Arizona	1,321	458,681	347	4	3.03	64	48.45	271	205.15	....	....
California	668	193,403	290	....	....	7	10.48	29	43.41	....	....
Colorado	785	260,052	331	5	6.37	30	38.22	97	123.57	2	1
Idaho	372	105,023	282	1	2.69	7	18.82	23	61.83	....	....
Illinois	178	44,794	252	....	....	1	5.62	33	185.39	....	....
Michigan	756	152,121	201	....	....	8	10.58	17	22.49	....	....
Missouri	1,657	489,091	295	1	.60	11	6.64	198	119.49	1	2
Montana	2,527	903,414	358	1	.40	23	9.10	166	65.69	1	....
Nevada	1,444	509,108	353	....	....	19	13.16	64	44.32	....	....
New Jersey	383	115,420	301	....	....	4	10.44	25	65.27	....	....
New Mexico	694	252,772	364	1	1.44	7	10.09	104	149.86	....	....
Oklahoma	254	83,795	330	....	....	3	11.81	8	31.50	....	....
Oregon	40	11,033	276	....	....	....	....	3	75.00	....	....
South Dakota	360	117,458	326	....	....	5	13.89	29	80.56	....	....
Tennessee	218	51,822	238	....	....	2	9.17	11	50.46	....	....
Texas	72	18,964	263	....	....	....	....	....	....	....	....
Utah	2,329	841,164	361	2	.86	97	41.65	434	186.35	1	....
Virginia	174	57,874	333	....	....	2	11.49	18	103.45	....	....
Washington	28	960	34	....	....	....	....	....	....	....	....
Wisconsin	197	53,678	272	....	....	3	15.23	65	329.95	....	....
Other States[a]	398	94,461	237	1	2.51	13	32.66	60	150.75	1	1
Total	**14,985**	**4,846,338**	**323**	**16**	**1.07**	**307**	**20.49**	**1,670**	**111.44**	**6**	**4**

[a] Includes Georgia, Kansas, Massachusetts, Minnesota, North Carolina, and Pennsylvania.

TABLE 12.—*Number of men employed, number of days worked, and number of men killed and injured at* **ore-dressing plants** *in the United States, in the calendar year* ***1914***.

State	Number of employees.	Total days worked.	Average active days.	Number killed.		Number seriously injured.		Number slightly injured.		Widows.	Orphans.
				Total.	Per 1,000 employed.	Total.	Per 1,000 employed.	Total.	Per 1,000 employed.		
Alabama	100	17,250	173	....	....	....	....	1	10.00	....	....
Alaska	225	76,046	338	1	4.44	3	13.33	27	120.00	1	....
Arizona	1,314	437,061	333	5	3.81	58	44.14	229	174.28	1	4
California	581	153,471	264	1	1.72	17	29.26	94	161.79	1	2
Colorado	960	292,491	305	2	2.08	17	17.71	86	89.58	2	....
Idaho	441	116,527	264	1	2.27	5	11.34	14	31.75	1	....
Illinois	164	36,325	221	....	....	2	12.20	1	6.10	....	....
Michigan	1,761	493,875	280	1	.57	25	14.20	26	14.76	1	....
Missouri	1,466	401,615	274	2	1.36	12	8.19	168	114.60	2	3
Montana	1,082	322,649	298	4	3.70	20	18.48	101	93.35	1	....
Nevada	1,396	457,581	328	2	1.43	18	12.89	65	46.56	1	....
New Jersey	440	135,312	308	....	....	5	11.36	22	50.00	....	....
New Mexico	741	235,843	318	....	....	8	10.80	87	117.41	....	....
New York	145	31,151	215	....	....	4	27.59	8	55.17	....	....
Oklahoma	404	118,217	293	....	....	4	9.90	31	76.73	....	....
Oregon	142	33,960	239	....	....	1	7.04	4	28.17	....	....
South Dakota	358	129,410	361	....	....	4	11.17	6	16.76	....	....
Tennessee	87	27,131	312	....	....	....	....	1	11.49	....	....
Texas	57	18,465	324	....	....	1	17.54	6	105.26	....	....
Utah	2,054	719,243	350	4	1.95	16	7.79	195	94.94	1	....
Virginia	100	24,330	243	....	....	1	10.00	4	40.00	....	....
Washington	18	3,520	196	....	....	....	....	....	....	....	....
Wisconsin	175	39,624	226	....	....	....	....	16	91.43	....	....
Other States[a]	290	51,623	178	....	....	2	6.90	19	65.52	....	....
Total	**14,501**	**4,372,720**	**302**	**23**	**1.59**	**223**	**15.38**	**1,211**	**83.51**	**12**	**9**

[a] Includes Arkansas, Georgia, Iowa, Kansas, Massachusetts, Minnesota, North Carolina, South Carolina, and Wyoming.

TABLE 13.—*Number of men* **killed** *at* **ore-dressing plants** *in the United States, by causes, in the calendar year* **1913.**

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Rolls or stamps. 4	Tables, jigs, etc. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Falling objects (rocks, timbers, etc.). 9	Cyanide or other poisoning. 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Flying pieces of rock from sledging or crusher. 15	Other causes. 16	Total.
Alabama																	
Arizona								1	1			1				1	4
California																	
Colorado							1		2	1						1	5
Idaho	1																1
Illinois																	
Michigan																	
Missouri		1															1
Montana						1											1
Nevada																	
New Jersey																	
New Mexico																1	1
Oklahoma																	
Oregon																	
South Dakota																	
Tennessee																	
Texas																	
Utah						1	1										2
Virginia																	
Washington																	
Wisconsin																	
Other States [a]							1										1
Total	1	1				2	3	1	3	1		1				3	16

[a] Includes Georgia, Kansas, Massachusetts, Minnesota, North Carolina, and Pennsylvania.

TABLE 14.—*Number of men* **killed** *at* **ore-dressing plants** *in the United States, by causes, in the calendar year* **1914.**

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Rolls or stamps. 4	Tables, jigs, etc. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Falling objects (rocks, timbers, etc.). 9	Cyanide or other poisoning. 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Flying pieces of rock from sledging or crusher. 15	Other causes. 16	Total.
Alabama		1															1
Alaska						3						1				1	5
Arizona							1										1
California						1	1										2
Colorado						1											1
Idaho																	
Illinois		1															1
Michigan		1							1								2
Missouri						1		1	1			1					4
Montana									1							1	2
Nevada																	
New Jersey																	
New Mexico																	
New York																	
Oklahoma																	
Oregon																	
South Dakota																	
Tennessee																	
Texas				2			1	1									4
Utah																	
Virginia																	
Washington																	
Wisconsin																	
Other States [a]																	
Total		3		2		6	3	2	3			2				2	23

[a] Includes Arkansas, Georgia, Iowa, Kansas, Massachusetts, Minnesota, North Carolina, South Carolina, and Wyoming.

TABLE 15.—*Number of men* ***seriously injured*** *at* ***ore-dressing plants*** *in the United States, by causes, in the calendar year* ***1913.***

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Rolls or stamps. 4	Tables, jigs, etc. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Falling objects (rocks, timbers, etc.). 9	Cyanide or other poisoning. 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Flying pieces of rock from sledging or crusher. 15	Other causes. 16	**Total.**
Alabama							1										1
Arizona	5			2	4	4	16		7		1	2	5		1	17	64
California	1					2	1					1				2	7
Colorado	3		2		2	3	6		5	1		1				7	30
Idaho	1	1		1	1	2										1	7
Illinois	1																1
Michigan					1	5	1		1								8
Missouri					1	4			3						1	2	11
Montana	1	1	3		3	4	3		4		1		2			1	23
Nevada	1	1		2		4			3			1	1			6	19
New Jersey			1				2									1	4
New Mexico	1					4	1		1								7
Oklahoma		1									1					1	3
Oregon																	
South Dakota				1		1										3	5
Tennessee					1				1								2
Texas																	
Utah	4	2		1	1	26	19		22		1		5	1		15	97
Virginia															2		2
Washington																	
Wisconsin	1					2											3
Other States [a]		4					1		4				1			3	13
Total	19	10	6	7	14	61	51		51	1	4	5	14	1	4	59	307

[a] Includes Georgia, Kansas, Massachusetts, Minnesota, North Carolina, and Pennsylvania.

TABLE 16.—*Number of men* ***seriously injured*** *at* ***ore-dressing plants*** *in the United States, by causes, in the calendar year* ***1914.***

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Rolls or stamps. 4	Tables, jigs, etc. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Falling objects (rocks, timbers, etc.). 9	Cyanide or other poisoning. 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Flying pieces of rock from sledging or crusher. 15	Other causes. 16	**Total.**
Alabama																	
Alaska				1	1											1	3
Arizona	3		3		2	10	9		5		1		3		1	21	58
California	2			3	1	3	3		1					2		2	17
Colorado	4			3		2	2		1			1	1	1		2	17
Idaho						2							1		1	1	5
Illinois													1			1	2
Michigan	2				1	6	6		2				3			5	25
Missouri					4	1			1						5	1	12
Montana			2		1	3	9		3				1			1	20
Nevada		2				3	1		2	1		1	1		1	6	18
New Jersey	2		1				1									1	5
New Mexico						2			1				2	2		1	8
New York	2					1						1					4
Oklahoma	1					1									1	1	4
Oregon						1											1
South Dakota				1		1	1									1	4
Tennessee																	
Texas						1											1
Utah	3					4	1		4			1	1			2	16
Virginia							1										1
Washington																	
Wisconsin																	
Other States [a]		1							1								2
Total	19	3	6	8	10	41	34		21	1	1	4	14	5	9	47	223

[a] Includes Arkansas, Georgia, Iowa, Kansas, Massachusetts, Minnesota, North Carolina, South Carolina, and Wyoming.

TABLE 17.—*Number of men* ***slightly injured*** *at* ***ore-dressing plants*** *in the United States, by causes, in the calendar year* **1913.**

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Rolls or stamps. 4	Tables, jigs, etc. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Falling objects (rocks, timbers, etc.). 9	Cyanide or other poisoning. 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Flying pieces of rock from sledging or crusher. 15	Other causes. 16	Total.
Alabama	5					2	4						3			1	15
Arizona	9			1	8	16	29		52	1	7	3	41	16	18	70	271
California	3					4	3		7	1			2		2	7	29
Colorado	14			1		17	12		17	2		2	6	5	1	20	97
Idaho	4				2	3	2		6		1	1		1		3	23
Illinois	2			1									7	5		18	33
Michigan					2	5	4		5							1	17
Missouri	14	8	10	6	10	11	10		18		4	1	7	3	48	48	198
Montana	8	4	14	9	16	22	29		20			1	17	8	1	17	166
Nevada	1	1	1	4		11	10		12	2			7	3	2	10	64
New Jersey	1	4			3	1	6		4				4	1		1	25
New Mexico	7					16	14		17		3	2	14	5		26	104
Oklahoma									1							7	8
Oregon					1	1				1							3
South Dakota													10		8	11	29
Tennessee		1			1	3	1		2				1		2		11
Texas																	
Utah	6	6	2	2	7	45	56		145		2	6	44	23	7	83	434
Virginia									4						8	6	18
Washington																	
Wisconsin	5						3		5				4		30	18	65
Other States [a]					1	1	4		1		3		18	3	1	28	60
Total	**79**	**24**	**27**	**24**	**51**	**158**	**187**		**316**	**7**	**20**	**16**	**185**	**73**	**128**	**375**	**1,670**

[a] Includes Georgia, Kansas, Massachusetts, Minnesota, North Carolina, and Pennsylvania.

TABLE 18.—*Number of men* ***slightly injured*** *at* ***ore-dressing plants*** *in the United States, by causes, in the calendar year* **1914.**

	Haulage system (cars, motors, etc.). 1	Railway cars or locomotives. 2	Crushers. 3	Rolls or stamps. 4	Tables, jigs, etc. 5	Other machinery. 6	Falls of persons. 7	Suffocation in ore bins. 8	Falling objects (rocks, timbers, etc.). 9	Cyanide or other poisoning. 10	Scalding (steam or water). 11	Electricity. 12	Hand tools. 13	Nails, splinters, etc. 14	Flying pieces of rock from sledging or crusher. 15	Other causes. 16	Total.
Alabama																1	1
Alaska	3		1	9		2	1		1	1	1		6	1		1	27
Arizona	9		2	5	6	31	25	2	25	1	2	1	21	18	2	79	229
California	4	18	1	1		2	6		30			1	7	3	3	18	94
Colorado	14			4	1	7	19		4	5		2	7	3	2	18	86
Idaho	1		1		1	1	2		3				1			4	14
Illinois		1															1
Michigan	1	2			1	3	8		3			1	3	1		3	26
Missouri	11	6	1	2	7	16	16		22			1	19	10	21	36	168
Montana	6		1	3	5	21	16		11			3	6	3		26	101
Nevada			1	3		10	15		7	1		3	4	7	1	13	65
New Jersey	1	1	3		4	1	4		4		1	2			1		22
New Mexico					4	8	16		19			2	8	19	1	10	87
New York	2	1				2	2					1					8
Oklahoma	2						4		12		1		9		2	1	31
Oregon						2									1	1	4
South Dakota							2					1	1			2	6
Tennessee									1								1
Texas						2	2						2				6
Utah	2	4		5	6	19	32		54		2	7	13	8	7	36	195
Virginia		1							1				1			1	4
Washington																	
Wisconsin	4		1	1		1			3			1	3			2	16
Other States [a]		1	5		1	1	1		1		1		8				19
Total	**60**	**35**	**17**	**33**	**36**	**129**	**171**	**2**	**201**	**8**	**8**	**26**	**119**	**73**	**41**	**252**	**1,211**

[a] Includes Arkansas, Georgia, Iowa, Kansas, Massachusetts, Minnesota, North Carolina, South Carolina, and Wyoming.

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Technical Paper 40. Metal-mine accidents in the United States during the calendar year 1911, compiled by A. H. Fay. 1913. 54 pp.

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